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SHORT COMMUNICATION

TRANSLOCATION OF SULPHUR IN CHLOROTIC AND NON-CHLOROTIC PLANTS OF SUGARCANE RATOON

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Investigations were carried out on the first ratoon of sugarcane (cv. CoLk 8102) exhibiting chlorosis under subtropical condition to study the role of sulphur, if any, towards ratoon chlorosis. The distribution of sulphur differed significantly in chlorotic and non-chlorotic plants. The sulphur content in the root of chlorotic plants was twice that of non-chlorotic plants suggesting more accumulation in the roots of chlorotic than in non-chlorotic plants. The stalks of chlorotic plant recorded lower sulphur content than that of non-chlorotic plants, while, the leaf sheath and leaf lamina of non-chlorotic plants registered nearly two to four times higher sulphur content, respectively, than that of chlorotic plants. Thus, there is progressive higher accumulation of sulphur in the above-ground parts of non-chlorotic plants as compared to chlorotic ones. Translocation of sulphur from root to stalk was more than two times higher in non-chlorotic than the chlorotic plants suggesting that translocation of sulphur from root to stalk was restricted in chlorotic than non-chlorotic plants. Comparative translocations in chlorotic and non-chlorotic plants suggested that transport of sulphur from stalk to leaf sheath and from leaf sheath to leaf lamina were also decreased in chlorotic than non-chlorotic plants.

Key words: **Chlorosis, ratoon, sugarcane, sulphur translocation.**

Iron chlorosis is a widespread nutritional malady in sugarcane that limits the sugarcane productivity *vis-a-vis* sugar recovery in both the tropical and subtropical regions. It is particularly prevalent in young ratoon although it may and does affect the plant crop also at all the growth stages (Subba Rao 1978). Under subtropical condition, iron chlorosis of sugarcane ratoon was found to significantly reduce ratoon yield from 66.1 to 46.1 $t\,ha^{-1}$, brix from 20.66 to 17.98 per cent, pol from 18.62 to 15.03 per cent and purity from 90.14 to 83.62 per cent (Dey and Yadav 1996). The absolute quantities of Fe in first fully expanded leaves were 254 $\mu g\,g^{-1}$ in non-chlorotic and 291 $\mu g\,g^{-1}$ in chlorotic plants (Dey *et al.* 1999). Thus, the absolute quantity of Fe was not an index of ratoon chlorosis. The Fe/Mn ratio also could not be used as a yardstick of ratoon chlorosis (Dey and Yadav 1998). Since, sulphur is a part of ferredoxin which controls the electron transfer in light reaction of photosynthesis, it is possible that S might have some role in ratoon chlorosis. There is hardly any information regarding the role of S in ratoon chlorosis. An attempt was, therefore, made in the present investigation to study the difference in translocation of sulphur, if any, in chlorotic and non-chlorotic sugarcane ratoon.

Plant samples were collected during the tillering phase from the first ratoon of sugarcane (cv. CoLk 8102) exhibiting natural chlorosis under subtropical condition at Kharika Farm of the Institute. Samples were collected based on visual symptoms, which were further confirmed by absorption spectrum as described by Dey and Yadav

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(1996). Samples from non-chlorotic plants were collected for comparison. Plants were separated into root, stalk, leaf sheath and leaf lamina of last transverse marked (LTM) leaf followed by washing with acidified detergent solution and distilled water. Five replicated samples were dried in hot air oven at 65°C and digested in di-acid (HNO_3: $HClO_4$ = 3:1) mixture for analysis. Sulphur was estimated turbidimetrically using a Beckman DU 640 Spectrophotometer as per the method described by Chesnin and Yien (1951). The soil samples from the root zone were collected, dried and analysed for pH, $CaCO_3$ content, using standard analytical procedures. Available Cu, Fe, Mn and Zn contents in soil were estimated as per the method described by Lindsay and Norvell (1978) using Atomic Absorption Spectrophotometer (Hitachi Z-6100). The soils of the experimental site had pH 7.60 to 8.35, $CaCO_3$ 73 g kg^{-1} and DTPA extractable contents of Fe 4.8 mg kg^{-1}, Mn 5.6 mg kg^{-1}, Cu 1.3 mg kg^{-1} and Zn 1.6 mg kg^{-1}.

The translocation of sulphur in different plant parts was calculated as follows:

$$\text{Transport index of stalk (TIS)} = \frac{\text{Sulphur content in stalk}}{\text{Sulphur content in root}} \times 100$$

$$\text{Transport index of leaf sheath (TILS)} = \frac{\text{Sulphur content in leaf sheath}}{\text{Sulphur content in stalk}} \times 100$$

$$\text{Transport index of leaf lamina (TILL)} = \frac{\text{Sulphur content in leaf lamina}}{\text{Sulphur content in leaf sheath}} \times 100$$

Mean value of sulphur contents in the root of chlorotic plants was two times higher than that of non-chlorotic plants (Table 1). This suggested the higher accumulation of sulphur in the roots of chlorotic than that of non-chlorotic plants. In contrast, the stalk of chlorotic plant recorded lower sulphur content than that of non-chlorotic plants. Similarly, the leaf sheath of non-chlorotic plant registered 2.5 times higher sulphur content than that of chlorotic plants. Likewise, the lamina of non-chlorotic plants recorded four times higher sulphur content than that of chlorotic plants. The results indicated progressive higher accumulation of sulphur in the above-ground plant parts (from stalk to leaf lamina) of non-chlorotic plants as compared to chlorotic ones.

Table 1. Sulphur content in different plant parts of chlorotic and non-chlorotic sugarcane ratoon.

Plant part	Sulphur content (mg g^{-1})	
	Chlorotic	Non-chlorotic
Root	0.6±0.03	0.3±0.01
Stalk	1.68±0.20	1.80±0.20
Leaf sheath	2.02±0.30	5.50±0.50
Leaf lamina	0.33±0.02	1.34±0.10

Values are expressed as mean ± standard deviation

Sulphur translocation in different parts of chlorotic and non-chlorotic plants are presented in Fig. 1. In non-chlorotic plants, transport index of stalk was more than two times higher than that of chlorotic plants indicating that sulphur translocation from root to stalk was comparatively difficult in chlorotic than the non-chlorotic plants. Similarly, translocation of sulphur from stalk to leaf sheath in case of non-chlorotic plants was 2.5 times higher than that of chlorotic plants. Translocation of sulphur from leaf sheath to leaf lamina was 1.5 times higher in non-chlorotic than the chlorotic plants. Therefore, translocation of sulphur from root to upper plant part is comparatively restricted in chlorotic than the non-chlorotic plants.

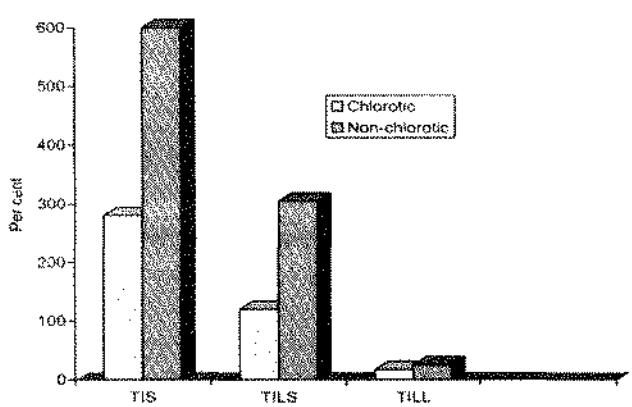

Fig. 1. Translocation of sulphur in chlorotic and non-chlorotic sugarcane ratoon (TIS, transport index of stalk; TILS, transport index of leaf sheath; TILL, transport index of leaf lamina)

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